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BUREAU OF MINES MINERALS YEARBOOK

# The Mineral Industry of North Carolina

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

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# The Mineral Industry of North Carolina

**The chapter has been prepared under a Memorandum of Understanding between the Bureau of Mines, U.S. Department of the Interior, and the Division of Land Resources, North Carolina Department of Natural Resources and Community Development, for collecting information on all nonfuel minerals.**

By Doss H. White, Jr.[1] and Albert Carpenter III[2]

In 1987, the value of North Carolina's nonfuel mineral production totaled $477 million, another record year for the State's mineral producers. Construction sand and gravel and crushed stone accounted for $267 million or 56% of the total. Although production increased for many mineral commodities mined in the State, output fell for feldspar, lithium, olivine, industrial sand, and dimension stone. North Carolina continued to lead the Nation in the production of feldspar, mica, lithium (spondumene), olivine, and pyrophyllite, and ranked second in common clay, crushed granite, and phosphate rock output.

During the year exploration and/or beneficiation studies were under way at four metallic ore bodies. In the area of industrial minerals, one of North Carolina's two lithium operations was for sale, and work continued on a new mica mine and plant. Three granite producers complained to the U.S. International Trade Commission (ITC) that foreign firms were selling stone in the United States below production costs.

**Table 1.—Nonfuel mineral production in North Carolina[1]**

| Mineral | 1985 | | 1986 | | 1987 | |
|---|---|---|---|---|---|---|
| | Quantity | Value (thousands) | Quantity | Value (thousands) | Quantity | Value (thousands) |
| Clays: thousand short tons | 2,688 | $10,477 | 2,658 | $10,970 | 3,229 | $15,282 |
| Feldspar: short tons | 490,993 | 13,351 | 526,672 | 15,568 | 512,386 | 15,562 |
| Gem stones | NA | e50 | NA | 551 | NA | 550 |
| Gold (recoverable content of ores, etc.): troy ounces | | | 12 | 4 | | |
| Mica (scrap): thousand short tons | 80 | 3,726 | 89 | 4,641 | 100 | 5,607 |
| Peat: do. | W | W | 15 | W | W | W |
| Sand and gravel: | | | | | | |
| Construction: do. | e6,100 | e19,500 | 7,543 | 23,127 | e8,600 | e30,100 |
| Industrial: do. | 1,294 | 13,086 | 1,464 | 16,656 | 1,184 | 15,329 |
| Stone: | | | | | | |
| Crushed: do. | 41,771 | 194,818 | e43,500 | e206,500 | 48,847 | 237,181 |
| Dimension: do. | 35 | 6,132 | e41 | e6,633 | 33 | 5,128 |
| Talc and pyrophyllite: do. | 85 | 1,604 | 83 | 1,552 | W | W |
| Combined value of lithium minerals, olivine, phosphate rock, and values indicated by symbol W | XX | r203,442 | XX | r180,528 | XX | 152,178 |
| Total | XX | r466,186 | XX | 466,730 | XX | 476,917 |

eEstimated. rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "Combined value" figure. XX Not applicable.

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

**Table 2.—Nonfuel minerals produced in North Carolina in 1986, by county[1]**

| County | Minerals produced in order of value |
|---|---|
| Alamance | Clays. |
| Anson | Sand (industrial). |
| Avery | Mica, clays. |
| Beaufort | Phosphate rock, sand and gravel. |
| Bertie | Sand and gravel. |
| Bladen | Do. |
| Brunswick | Do. |
| Buncombe | Do. |
| Burke | Do. |
| Cabarrus | Clays, sand and gravel. |
| Caldwell | Sand and gravel. |
| Camden | Do. |
| Carteret | Do. |
| Catawba | Do. |
| Chatham | Clays. |
| Chowan | Sand and gravel. |
| Cleveland | Lithium, mica, sand and gravel, clays, feldspar. |
| Craven | Sand and gravel. |
| Cumberland | Do. |
| Dare | Do. |
| Davidson | Clays. |
| Davie | Sand and gravel. |
| Duplin | Do. |
| Durham | Clays. |
| Edgecombe | Sand and gravel. |
| Franklin | Do. |
| Gaston | Mica, feldspar, lithium. |
| Guilford | Clays, sand and gravel. |
| Halifax | Clays. |
| Harnett | Sand and gravel (industrial), clays. |
| Henderson | Clays. |
| Hertford | Sand and gravel. |
| Hoke | Do. |
| Hyde | Peat, sand and gravel. |
| Iredell | Clays. |
| Jackson | Olivine. |
| Johnston | Sand and gravel. |
| Lee | Clays, sand and gravel. |
| Lenoir | Sand and gravel. |
| McDowell | Do. |
| Macon | Do. |
| Martin | Do. |
| Mitchell | Feldspar, mica, sand and gravel. |
| Montgomery | Sand and gravel, clays. |
| Moore | Pyrophyllite, sand and gravel, clays. |
| Nash | Sand and gravel. |
| New Hanover | Do. |
| Northampton | Do. |
| Onslow | Do. |
| Orange | Pyrophyllite. |
| Pasquotank | Sand and gravel. |
| Pender | Do. |
| Pitt | Do. |
| Richmond | Sand (industrial). |
| Rockingham | Clays, sand and gravel. |
| Rowan | Clays. |
| Rutherford | Sand and gravel. |
| Sampson | Clays, sand and gravel. |
| Scotland | Sand and gravel. |
| Stanly | Clays, old. |
| Stokes | Sand and gravel, clays. |
| Surry | Sand and gravel. |
| Tyrrell | Do. |
| Union | Clays. |
| Washington | Sand and gravel. |
| Watauga | Do. |
| Wayne | Do. |
| Wilkes | Do. |
| Wilson | Do. |
| Yadkin | Do. |
| Yancey | Olivine, sand and gravel, mica. |
| Undistributed[2] | Stone, gem stones. |

[1]No production of nonfuel mineral commodities was reported for counties not listed.
[2]Data not available by county for minerals listed.

**Trends and Developments.**—During the 1980's (1980-87), North Carolina's mineral value increased over $97 million, and by 1987 was approaching the one-half billion-dollar level. Only during the recession of the early 1980's did year-to-year value fall, and by 1983 mineral sales had regained their upward climb, exceeding the 1980 level by $18 million.

For the past several years North Carolina's mineral value has been derived entirely from the extraction and processing of industrial minerals. However, in 1987 the prospect of an extractive metals industry appeared as a distinct possibility as four companies conducted exploration programs for gold in Davidson, Moore, Randolph, and Union Counties. An Oregon company applied for permits for a proposed titanium plant in eastern North Carolina.

In the industrial minerals sector, Newmont Mining Corp. was seeking a buyer for Foote Mineral Co., the large domestic lithium producer with a mine, mill, and chemical plant at Kings Mountain. J. M. Huber Corp. began work on a dry ground-mica plant at Kings Mountain. The plant and adjacent mine were scheduled for operation in mid-1988.

**Exploration Activities.**—Niagara Capital Company continued exploration and beneficiation studies for gold and other metals at the old Silver Hill Mine in Davidson County. Unconfirmed preliminary news releases reported 144,000 short tons of reserves grading 0.15 troy ounces of gold per ton, 1.49 troy ounces of silver per ton, and a combined grade of 19.4% lead-zinc per ton.[3]

Adena Minerals Co. filed an application with the State Department of Natural Resources and Community Development to develop a 125-acre gold property in Moore County near Robbins. The company would employ a heap-leach process utilizing sodium cyanide to recover the gold from a low-grade ore.

Carolina Gold Resources continued exploration work at the old Allred gold mine near Grays Chapel in Randolph County, and Cominco American was conducting exploration work at the old Howie Mine near Waxhaw.

**Legislation and Government Programs.**—A bill (Senate bill 486) that would levy a severance tax on the mining of phosphate rock was introduced in the North Carolina Senate. The tax would be $2.23 per short ton. The bill was still in the Finance Committee when the legislature adjourned in August.

In October a joint North Carolina-Virginia committee was formed to study a plan to pump water from the Texasgulf Chemical Co. mine at Aurora to northeastern North Carolina and southeastern Virginia. Approximately 46 million gallons of water per day was discharged from the Aurora phosphate operation into the Pamlico River.

## REVIEW BY NONFUEL MINERAL COMMODITIES

### INDUSTRIAL MINERALS

The value of industrial mineral production in North Carolina increased $10.2 million over that reported by producers in 1986.

**Clays.**—North Carolina ranked second among the 44 clay producing States, and the value of clay production was 3% of the total mineral output. North Carolina's clay producers mined 3.2 million short tons of clay valued at $15.3 million, a new record.

North Carolina's clay industry consisted of 35 companies operating 48 pits in 22 of the State's 100 counties. Common clay was produced at 46 of the pits, and 2 produced kaolin recovered as a coproduct with mica production. Primary uses of the common clays were for the manufacture of brick and other structural clay products; kaolin sales, in descending order of value, were for insulators, ceramics, and specialty brick manufacture.

**Feldspar.**—North Carolina feldspar production accounted for 71% of the Nation's total; however, output decreased 14,300 short tons from 1986. Compared with 1986, fewer housing starts in the market area for North Carolina feldspar resulted in reduced demand for feldspar in the manufacture of plumbing fixtures, tile, and glass fiber insulation.

Three companies mined alaskite, an ore that contains approximately 65% feldspar, and recovered a feldspar concentrate by flotation. Two companies recovered a feldspar-silica concentrate during lithium beneficiation, and a third recovered a feldspar concentrate as a byproduct of mica beneficiation. Shipments of marketable feldspar by U.S. producers to North Carolina increased from 20,700 short tons in 1986 to 40,500 short tons in 1987.

**Lithium.**—North Carolina's lithium production declined because Foote produced at a fraction of its capacity. Foote closed its Kings Mountain lithium chemical plant in May, 1986. The closure was due to lower operating costs at company plants in Nevada and Chile, as well as a lower-than-expected growth in lithium demand. At yearend, negotiations were under way with Cyprus Minerals Co. to buy Foote from Newmont Mining.

Lithium Corp. of America Inc. (Lithco) continued as the State's dominant lithium producer. Lithico's mine and plant were located near Cherryville in the Kings Mountain area. The company mined a spodumene-bearing pegmatite by open pit methods and produced a spodumene concentrate by flotation, which was used in the manufacture of lithium chemicals which, in turn, were sold on the open market, primarily to the aluminum, glass, and grease industries.

**Mica.**—In 1987, mica production in North Carolina accounted for 68% of the value and 62% of the tonnage produced in the United States. Production was greater than in 1986, primarily due to the strong construction sector and the demand for mica in joint compound and paint. Three companies, Deneen Mica Co., KMG Minerals Inc., and Unimin Corp., produced mica as a primary commodity; the three feldspar companies produced mica as a byproduct.

J. M. Huber Corp. broke ground in May for a 20,000-square-foot processing plant to recover moscovite mica from ore that would be mined on adjacent property. The $3.4 million plant was scheduled for completion in mid-1988.

**Olivine.**—Unimin Inc. operated the only olivine mine and plant in North Carolina. The plant wet ground olivine for sales to the foundry industry. Foreign competition had forced the closing of two of the State's olivine mines.

**Phosphate Rock.**—North Carolina continued to rank second nationally in the production of phosphate rock. Texasgulf Chemical Co. operated a mining, beneficiation, and phosphoric acid manufacturing complex at Lee Creek in Beaufort County. Dredges and draglines stripped the overburden. Draglines mined the ore, which was slurried to a flotation plant to produce a phosphate rock concentrate for phosphoric acid. The world's largest sulfuric acid plant was
housed at the complex.

During the year, several bucket-wheel excavators were erected to replace the dredges in stripping the upper portion of overburden. The excavators were obtained when Texasgulf purchased North Carolina Phosphate Corp.

In 1987, a bill was submitted to the North Carolina Legislature which, if enacted, would have placed a $2.23-per-short-ton severance tax on phosphate mined instate. The bill was defeated. At yearend, the company and the State were negotiating a new water-discharge permit. Under terms of the permit, Texasgulf would recycle all contaminated water that previously was discharged into the Pamlico River.

**Pyrophyllite.**—In 1987, North Carolina led the Nation in pyrophyllite output. Three companies, Standard Minerals Co. Inc. and Glendon Pyrophyllite Inc. in Moore County and Piedmont Minerals Co. in Orange County, operated four surface mines and three beneficiation plants. The product was used as an insecticide filler and carrier, wallboard and latex foam filler, and refractory material.

**Sand and Gravel.**—*Construction.*—Construction sand and gravel production is surveyed by the U.S. Bureau of Mines for even-numbered years only; this chapter contains estimates for 1985 and 1987 and actual data for 1986. Data for odd-numbered years are based on annual company estimates. Approximately 50% of North Carolina's construction sand and gravel was mined from 4 areas in 10 counties. These included, in descending order of tonnage, Cumberland and Harnett Counties; Anson, Montgomery, and Richmond Counties; Buncombe, McDowell, and Yancey Counties; and Cabarrus County. Production reached a record high because of the demand for aggregate in the construction industry.

*Industrial.*—In 1978, production of industrial sand and gravel was reported to the Bureau of Mines by seven companies operating seven mines in five counties. Over 80% of the production was from the Anson-Richmond contiguous county area. Mines in Cleveland, Harnett, and Mitchell Counties supplied the remainder. More than 50% of the sales were to the flat and container glass industries; other reported uses, in descending tonnages, were for the manufacture of ferrosilicon, filtration uses, sandblasting, and traction sand.

The Feldspar Corp. completed construction of its high-purity quartz facility near Spruce Pine. Plant feed is quartz obtained during the beneficiation of alaskite, a feldspar ore. Unimin Inc. operated a similar plant in the Spruce Pine area.

**Stone.**—Stone production is surveyed by the U.S. Bureau of Mines for odd-numbered years only; this chapter contains actual data for 1985 and 1987 and estimates for

1986. Data for even-numbered years are based on annual company estimates.

*Crushed.*—Throughout the year, the crushed stone industry continued to experience citizen opposition to the opening of new quarries. During 1987, state-local permits and/or rezoning actions were sought for 12 new quarries. The necessary rezoning was obtained by 1 company in the Bessemer City area; the other 11 had not been approved at yearend.

In 1985, the U.S. Bureau of Mines began compiling crushed stone statistics by districts for some States. Table 4 presents end-use data for crushed stone produced in the three North Carolina districts depicted in figure 1.

**Table 3.—North Carolina: Crushed stone[1] sold or used by producers in 1987, by use**

(Thousand short tons and thousand dollars)

| Use | Quantity | Value |
|---|---|---|
| Coarse aggregate (+1-1/2 inch): | | |
| Riprap and jetty stone | 587 | 3,221 |
| Filter stone | 171 | 747 |
| Coarse aggregate, graded: | | |
| Concrete aggregate, coarse | 5,973 | 31,112 |
| Bituminous aggregate, coarse | 2,966 | 15,852 |
| Bituminous surface-treatment aggregate | 967 | 4,733 |
| Railroad ballast | 1,721 | 7,325 |
| Fine aggregate (-3/8 inch): | | |
| Stone sand (concrete) | 578 | 2,760 |
| Stone sand, bituminous mix or seal | 447 | 2,003 |
| Screening, undesignated | 1,902 | 8,157 |
| Coarse and fine aggregates: | | |
| Graded road base or subbase | 12,525 | 54,805 |
| Unpaved road surfacing | 213 | 974 |
| Crusher run or fill or waste | 12,446 | 64,457 |
| Other construction[2] | 2,225 | 11,922 |
| Other miscellaneous[3] | 1,512 | 7,956 |
| Other unspecified[4] | 4,675 | 21,156 |
| Total[5] | 48,847 | 237,181 |

[1]Includes granite, limestone, traprock, slate, volcanic cinder and scoria, quartzite, and marl.
[2]Includes macadam, and terrazzo and exposed aggregate.
[3]Includes agricultural limestone, other agricultural uses, and flux stone.
[4]Includes production reported without a breakdown by end use and estimates for nonrespondents.
[5]Data may not add to totals shown because of independent rounding.

**Table 4.—North Carolina: Crushed stone sold or used by producers in 1987, by use and district**

(Thousand short tons and thousand dollars)

| Use | District 1 | | District 2 | | District 3 | |
|---|---|---|---|---|---|---|
| | Quantity | Value | Quantity | Value | Quantity | Value |
| Coarse aggregate (+1-1/2 inch)[1] | 158 | 866 | 219 | 1,471 | 398 | 1,731 |
| Coarse aggregate, graded[2] | 1,946 | 8,983 | 5,031 | 26,853 | 4,593 | 23,187 |
| Fine aggregate (-3/8 inch)[3] | 608 | 2,528 | 960 | 4,115 | 1,314 | 6,279 |
| Coarse and fine aggregates[4] | 2,876 | 11,830 | 13,481 | 64,573 | 9,105 | 45,384 |
| Other construction | 146 | 814 | 1,641 | 8,797 | 143 | 660 |
| Agricultural[5] | | | | | W | W |
| Chemical and metallurgical[6] | | | W | W | | |
| Other miscellaneous | 24 | 98 | 1,470 | 7,759 | 18 | 99 |
| Other unspecified[7] | 1,787 | 7,380 | 1,569 | 5,594 | 1,379 | 8,183 |
| Total[8] | 7,546 | 32,498 | 24,311 | 119,161 | 16,990 | 85,522 |

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous."
[1]Includes macadam, riprap and jetty stone, filter stone, and coarse aggregate (large).
[2]Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, and railroad ballast.
[3]Includes stone sand (concrete and bituminous mix or seal), and fine aggregate (screening, undesignated).
[4]Include graded road base or subbase, unpaved road surfacing, terrazzo and exposed aggregate, and crusher run or fill waste.
[5]Includes agricultural limestone and other agricultural uses.
[6]Includes flux stone.
[7]Includes production reported without a breakdown by end use and estimates for nonrepondents.
[8]Data may not add to totals shown because of independent rounding.

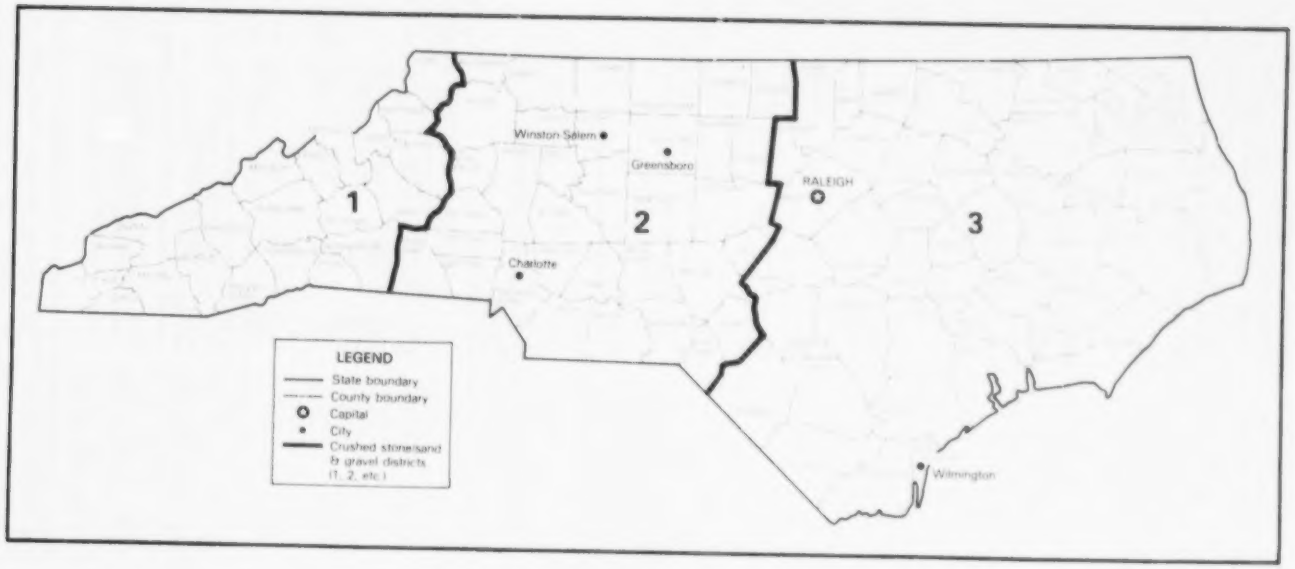


**Figure 1.—Aggregate-producing districts in North Carolina.**

*Dimension.*—North Carolina ranked seventh out of 36 States in the quarrying of dimension stone. Granite was quarried by five companies; sandstone, argillite and marble by one each.

The North Carolina Granite Corp., operator of the world's largest open-pit granite quarry, and two other domestic producers joined in seeking trade sanctions against Spanish and Italian granite producers. The foreign companies were accused of selling, with the help of government subsidies, granite in the United States below the foreign companies' production costs. The U.S. companies requested that ITC levy tariffs preliminarily on granite imports.

**Other Industrial Minerals.**—The State ranked high in the eastern United States in the number of mines and businesses producing or selling gem stones and mineral specimens. Principal gem-collecting counties, all in the western part of the State, were Alexander (emeralds and hiddenite), Macon (rubies, sapphires and garnets), and Mitchell (emeralds and aquamarine). Two companies, Great Lakes Carbon Corp. at Morganton and Morganite Inc. at Dunn, manufactured a variety of products from synthetic graphite. National Gypsum Co. imported crude gypsum from Canada for use in wallboard manufacturing at a plant in Wilmington. Texasgulf Inc. produced a byproduct gypsum during phosphoric acid manufacture at its fertilizer complex at Lee Creek. A small smount was sold as a soil conditioner; however, much of the output was mixed with clay and pumped back into the mined-out phosphate pits. Byproduct slag was produced as a waste product by the Florida Steel Corp.'s plant in Charlotte. The slag was marketed for use as an aggregate. The Warner Corp. in Murphy manufactured talc crayons for the steel industry from crude talc imported from China. The company closed its underground talc mine in December 1986, because of high production costs as compared to talc imported from developing countries.

## METALS

Metal mining in North Carolina terminated in 1971 when the Tungsten Queen Mine near Townsville in Vance County closed. In 1987 a variety of metallic ores or semiprocessed products were shipped into North Carolina for processing into a higher value, finished product.

| Commodity | Company | Location | Remarks |
|---|---|---|---|
| Aluminum | Aluminum Co. of America | Badin | 115,000-metric-ton-per-year smelter. |
| Chromium | Occidental Chemical Corp | Castle Hayne | 1 of 2 primary chromium chemical plants in the United States. |
| Cobalt | Carolmet Inc | Laurenburg | Only powdered cobalt plant in the United States. |
| Copper | SCM Co., Glidden Metals Div. | Durham | Powdered copper. |
| Lithium | Lithium Corp. of America Inc. | Cherryville | Lithium metal. |
| Silver | E. I. du Pont de Nemours & Co. | Arden | Silver emulsions separated from film waste. |
| Steel | Nucor Corp. | Charlotte | Two 35-ton furnace minimill. |

Aluminum Co. of America restarted an idled half-potline in June at the company's aluminum smelter at Badin. Albany Titanium Inc., an Oregon company, applied for State permits for a proposed titanium plant on Texasgulf Chemical Co. property in eastern North Carolina. The plant would process ilmenite shipped from Florida by barge.

[1]State Mineral Officer, Bureau of Mines, Tuscaloosa, AL.

[2]Geologist, North Carolina Geological Survey Section, Raleigh, NC.

[3]World Investment News. New Life for Historic Mine. June 1987, p. 19.

**Table 5.—Principal producers**

| Commodity and company | Address | Type of activity | County |
|---|---|---|---|
| Aluminum, smelter: | | | |
| Aluminum Co. of America | 1501 Alcoa Bldg.<br>Pittsburgh, PA 15219 | Plant | Stanly |
| Clays: | | | |
| Hammill Construction Co. | Route 2, Box 33H<br>Gold Hill, NC 28071 | Surface mines and plant | Cabarrus and Rowan |
| Pine Hall Brick & Pipe Co. | Box 11044<br>Winston-Salem, NC 27105 | do. | Rockingham and Stokes |
| Virginia Solite Corp. | Box 27211<br>Richmond, VA 23261 | do. | Rockingham and Stanly |
| Feldspar: | | | |
| The Feldspar Corp.[1] | Box 99<br>Spruce Pine, NC 28777 | do. | Mitchell |
| Indusmin Inc.[1] | Box 309<br>Spruce Pine, NC 28777 | do. | Do. |
| Unimin Corp.[1] | Box 628<br>Spruce Pine, NC 28777 | do. | Do. |
| Lithium: | | | |
| Foote Mineral Co.[2] | Box 792<br>Kings Mountain, NC 28086 | Surface mine and plant | Cleveland. |
| Lithium Corp. of America Inc.[1 2] | 449 North Cox Rd.<br>Gastonia, NC 28052 | do. | Gaston. |
| Mica: | | | |
| Deneen Mica Co. | Box 28<br>Micaville, NC 28755 | Surface mines | Yancey. |
| Unimin Corp.[3] | Box 628<br>Spruce Pine, NC 28777 | do. | Avery. |
| KMG Minerals Inc.[2] | Box 729<br>Kings Mountain, NC 28086 | Surface | Cleveland. |
| Olivine: | | | |
| AIMCOR | Box 672<br>Spruce Pine, NC 28777 | do. | Jackson and Yancey. |
| Perlite (expanded): | | | |
| Carolina Perlite Co. Inc. | Box 741<br>Hillside, NJ 07205 | Plant | Rowan. |
| Phosphate rock: | | | |
| Texasgulf Inc.[4] | Box 48<br>Aurora, NC 27806 | Surface mine and plant | Beaufort. |
| Pyrophyllite: | | | |
| Glendon Pyrophyllite Inc. | Box 306<br>Carthage, NC 28327 | Surface mines and plant | Alamance and Moore. |
| Piedmont Minerals Co.[5] | Box 7247<br>Greensboro, NC 27407 | Surface mine and plant | Orange. |
| Standard Minerals Co. Inc. | Box 278<br>Robbins, NC 27325 | do. | Moore. |
| Sand and gravel (construction): | | | |
| Becker Sand & Gravel Co. | Box 609<br>Lillington, NC 27546 | Pits | Anson and Harnett. |
| W. R. Bonsal Co. | Box 38<br>Lilesville, NC 28091 | do. | Anson. |
| B. V. Hedrick Gravel and Sand Co.[1] | Box 8<br>Lilesville, NC 28091 | do. | Buncombe. |
| Stone: | | | |
| Martin Marietta Corp. | Box 30013<br>Raleigh, NC 27622 | do. | Various. |
| Nello L. Teer Co. | Box 1131<br>Durham, NC 27702 | do. | Do. |
| Vulcan Materials Co., Mideast Div. | Box 7497<br>Winston-Salem, NC 27109 | do. | Do. |
| Vermiculite (exfoliated): | | | |
| W. R. Grace & Co. | 62 Whittemore Ave.<br>Cambridge, MA 02140 | Plant | Guilford. |

[1]Also mica.
[2]Also feldspar.
[3]Also clays.
[4]Also byproduct gypsum.
[5]Also sericite.

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